Spatial-temporal disaggregation of daily rainfall: combining a daily GLM and a single-site model for simulation of hourly rainfall fields

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Based on daily raingauge data, Generalised Linear Models (GLMs) can be used to model the spatial variability of daily rainfall (Chandler and Wheater, 2002), including temporal non-stationarities in rainfall sequences (e.g. climate change) and spatial patterns (e.g. elevation and other location effects). However, since hourly data are more appropriate for most flow simulation purposes, an adequate disaggregation procedure is required to constitute an hourly generator. We examine the possibility of generating hourly rainfall through a GLM combined with a single-site disaggregation model using Poisson cluster processes (Koutsoyiannis and Onof, 2001). As a first approach, complete spatial dependence is assumed and a spatially uniform temporal disaggregation is applied at all sites. The approach is evaluated for a study area in the Thames catchment, UK, with 15 years of records from 21 raingauges covering an area of 1400 km^2. The proposed model is able to reproduce standard statistics and performs well in terms of extremes. The method can be extended to sites not used in model calibration.